

Report on Turtle Distribution and
Commercial Shrimp Trawling: A Descriptive
Analysis Stratified by
Relative Water Depth
By

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January 8, 1991

Miami Laboratory Contribution
No. MIA - 90/91 - 25

Executive Summary

- o An Examination of SEFC marine turtle distributional data and commercial shrimp trawling effort data shows that these distributions overlap throughout the Gulf of Mexico.
- o While commercial shrimp trawling effort decreases with increasing depth in the western Gulf of Mexico the distribution of turtles appears uniform.
- o In the eastern Gulf of Mexico, the distribution of turtles and commercial shrimp trawling efforts are relatively uniform at depths less than and greater than 27 meters.
- o No estimates of CPUE stratified by depth are available but the density of turtles in waters beyond 27m is sufficient to suggest that values might be comparable to those available for waters less than 27m.

Introduction

An examination of the distributions of turtles and commercial shrimp trawling effort was completed using Southeast Fisheries Center data bases. The purpose this investigation was to determine if turtle and effort distributions could be spatially stratified by depth. To accomplish this task, various turtle data bases from the Galveston, Pascagoula, and Miami Laboratories were evaluated. Shrimp trawling effort was derived from the Galveston Laboratory. Data accompanied by location were applied in this analysis and distributions of both turtles and effort plotted. Depth contours of 15 and 30 fathoms were defined from NOAA nautical charts. The 15 fathom isobath is approximately equivalent to 27m in surface to bottom depth.

Materials and Methods

Turtle data contributed from Galveston included: satellite tag information, opportunistic sightings, and the TED evaluation study. From Pascagoula, site specific sighting data collected via aerial surveys was used. These data were collected to determine associations between turtles and oil platforms in the northern Gulf of Mexico could be measured. The only synoptic data set available was from the Miami Laboratory aerial survey program covering the entire Gulf of Mexico from Brownsville, Texas to Key West, Florida on to the 200m isobath from 1983-86 ("SETS" for Southeast Turtle Surveys).

Shrimp effort was defined according to "days fished" where one day equals 24 hours that nets are placed in the water column. Thus, for this exercise, effort represents the fishing time turtle could be caught. Data were for 1989 which is the most recent data available and provide a reasonable representation of annual effort (E. Klima 1991 pers. comm.). To facilitate interpretation of the overlap of turtle and effort distributions, effort grids were defined in 5,000 days increments, with 0-5000 days fished as the lowest and 25,000 the highest increments.

Results

Aerial Surveys

Synoptic Aerial Surveys

From 1983 through 1986, seasonal aerial surveys were completed from the coastline of the Gulf of Mexico out to the 200m (100 fathom) isobath. The purpose of these surveys was to provide data for the estimation of dolphin (Tursiops truncatus) density and marine turtle density on a synoptic basis. Results provide the

first such estimates for the entire Gulf of Mexico. The study area (Fig.1) was divided into two sampling areas to optimize coverage over variable depths. The Northwestern Gulf, (NW) was defined as from the Rio Grande River to the mouth of the Mississippi River, a total of 144,056km² (Fig. 2); and the Northeastern Gulf (NE), from the Mississippi River to Key West, Florida, a total of 219,514km² (Fig. 3).

Sampling areas were defined based on water depth (ie. depth to bottom) and termed "bay", "inshore", and "offshore" (Fig. 1). "Bays" included bays, grounds, and lagoons; inshore included waters from the coastline or oceanside from barrier islands to 18m (10fathoms) and "offshore" included waters from 18m to 200m in depth. This scheme optimized coverage over depth such that 15% of the bays, 12% of inshore, and 7% of the offshore surface waters were sampled. Overall coverage averaged 10%.

The survey platform was a twin engine Beechcraft D-18, equipped with a plexiglass observation bubble on the nose. Four observers were rotated through the observation bubble, such that there were two observers in the bubble during surveys. All possible transects were placed at 1.4km intervals and randomly selected to meet the aforementioned sampling coverage.

All surveys were from an altitude of 229m (750ft), at about 222km/hr (120 knots) ground speed. Four surveys were completed in the Northwestern Gulf and three in the Northeastern Gulf. Data reported included species identification, location, time and date, various environmental conditions, and animal behavior.

In the NW, total of 70 loggerhead turtles were reported at the water's surface (Fig. 2). These turtles are likely no less than 75cm (2½ ft) carapace length based on results of previous surveys conducted by NMFS. Thus, turtles sighted are most likely sub-adult and adult. Aerial surveys also tend to be specific to targeting loggerhead and leatherback turtles which are both large. In addition, the color of the loggerhead provides sufficient contrast to the background color to be observed if large enough. Thus, the presence/absence of both green and Kemp's ridley turtles cannot be determined directly from these data. Notably, there were no sub-adult or adult loggerhead turtles sighted within NW Gulf bays. Of the total 70 turtles reported, about 30% were sighted in inshore waters and 70% in offshore waters out to 200 m.

In the NE Gulf, a total of 1,304 sub-adult and adult loggerhead turtles were reported at the water's surface. of these, 6% were from bays, 73% from inshore waters, and 21% from offshore waters out to 200 m (Fig. 3). When relating these turtle

distributions to shrimping effort, it is obvious that the distribution of turtles overlaps and extends beyond the extent of commercial shrimp trawling. Waters in which there is no shrimp trawling and turtles are present, do not require regulation of the shrimp trawling industry. In the NW Gulf, the relative intensity of shrimping effort decreases when moving to offshore waters. However, the majority of sightings in offshore waters was greater than inshore waters suggesting the turtle CPUE might be higher in offshore relative to inshore waters. The results of Henwood and Stuntz (1987. Analysis of sea turtle captures and mortalities during commercial shrimp trawling. Fish. Bull. 85(4):813-817) are representative of the catch of turtles in inshore waters (T. Henwood, Personal Communication 1990), which is where they were able to sample. Thus, their CPUE estimates are probably not applicable to offshore waters of the NW Gulf.

In the NE Gulf, turtles tended to concentrate in inshore waters but were present in relatively large numbers in offshore as compared to bay waters. However, shrimp trawling effort appears to be more uniform over these waters with the exception of waters near the Dry Tortugas and in inshore waters from the Mississippi River to Mobile Bay. Over both areas, turtles were present over all depths during all seasons. Thus, gasml stratification appears not to be possible.

Site Specific Aerial Surveys

From June 1988 through June 1990 site specific aerial surveys were completed with funding from the U.S. Dept. of Interior, Minerals Management Service (MMS). The purpose of these surveys was to evaluate associations between turtles and oil platforms (Lohoefer, R., Wittogard, K. Mullin, C. Roden, and C. Rogers. 1990 Association of sea turtles with petroleum platforms in the North-Central Gulf of Mexico. OCS Study/MMS 90-0025. U.S. DDI/MMS, Gulf of Mexico OCS Regional Office, New Orleans, LA. 90pp). Specific sampling sites off the Louisiana coast were divided into "inshore" (<200M) and "offshore" (>200m) areas. (Fig. 4).

Sampling sites were selected based on platform density and estimated sampling time. Surface to bottom water depth in the inshore sites varied from 6 to 65m and were sampled from 1988 through 1990. Offshore sites were up to 2000m in depth and were sampled from 1989 through 1990.

The survey platform was a de-Havilland (DC-8) Twin Otter airplane from NOAA's Aircraft Operations Center, Miami, Florida. Surveys altitude was 229m (750ft) and speed was 167 m/hr (90 knots). Surveys were conducted weekly to maximize positional

information on turtles relative to survey depth and platform position. Turtles were reported to species level as possible. In addition, time and location, and various environmental conditions were recorded.

The distribution of turtles within study areas is shown in figure 5. Turtles were sighted at all depths throughout the selected study areas.

TED Evaluation Study

To compare catch rates of shrimp for TED equipped trawls and standard trawls without TED's a program was initiated by the SEFC, Galveston Laboratory in 1988. Vessels for placement of NMFS trained observers were recruited with the assistance of NMFS SEFC port agents, NOAA Sea Grant Marine Advisory Agent, regional shrimp associations, and industry contacts. Captains participating allowed one half of the total nets to include a certified TED chosen by the captain. The other half of the total nets remained without TEDs. Sampling coverage was dependent upon the willingness of a captain to carry a NMFS observer. The captain was permitted to fish "as usual".

A total of 15 turtles were captured in the Gulf of Mexico within standard nets. Four of these were off Louisiana and 11 off the Florida west coast (Figs. 6 and 7). These data represent where turtles were caught by participating vessel captains. Sampling was biased by location because of the relative magnitude of effort off the Louisiana coast; that is turtles were caught in the most fished areas, which represents the area sampled. In some cases, the absence of turtle captures is a result of a lack of sampling rather than a true absence.

Other Sampling

Turtle Hot Spots

No research plan is in place to gather this type of information (Fig. 8). The source of these data were through phone calls from fishermen and workers in the offshore petroleum industry. Data were later verified by Texas-State or Federal personnel. Circles represent areas where up to 20 separate turtles have been reported in a single day or several sightings of turtles have occurred throughout the year, mainly during the summer and fall. These areas represent regions around specific platforms or fields of platforms in the Gulf of Mexico.

Satellite Tracking

Although no research plan is in place to gather this type of information, NMFS is interested in evaluating the behavior and movements of sea turtles across and between shrimping grounds. Satellite tags were placed on turtles 1) captured opportunistically during platform removal operations in the Gulf of Mexico, or 2) captured during short trips set up specifically to catch turtles, based on information from fishermen. Two juvenile and 1 adult loggerhead were captured and released inside of 15 fm where they remained throughout the life of the satellite tag (Fig. 9). One adult loggerhead was captured and released outside of 15 fm. It remained within a 5 mile radius for approximately for approximately 9 months. Circles represent areas where turtles spent from 1 to 9 months.

Turtles sightings From The Western and Central Gulf of Mexico, and Turtle Sightings From The Central and Eastern Gulf of Mexico, 1985-1989.

The Galveston laboratory has maintained a sea turtle sighting file since 1985. Its purpose was to compile and maintain a data base on turtle sightings in the Gulf of Mexico. A sighting is an event in which a sea turtle is seen, usually swimming at the surface of the water. Sea turtle strandings or turtles caught in trawls are excluded from this file. All sightings are opportunistic events reported by the public or in conjunction with ongoing NMFS observer programs. Sightings were reported by divers, oil company personnel, commercial and recreational fishermen, beach goers and NMFS employees (Fig. 10 and 11). Bias exists in the file since the majority of the sightings were reported by NMFS observers working on TED testing and oil platform removals, most of which occur in Texas and Louisiana. Regardless of the sampling bias, sightings were reported beyond 60m in the NW Gulf. These results are remarkably similar to these from the synoptic aerial survey program off the NW Gulf.

Conclusion

Based on the examination of turtle and shrimp trawling effort distributions, it appears that the distribution of turtles extends beyond the extent of trawling and throughout the shrimping trawling season. Thus, wherever shrimping occurs, turtles are present. Both shrimp trawling effort and turtle sightings extend beyond 15 fathoms (30m). The absence of sightings in bay waters from these aerial surveys does not mean juvenile turtles or green or Kemp's ridley turtles were not present. These aerial surveys may target adult and sub-adult loggerhead and leatherback turtles. Notably, Hildebrand (1981. A historical review of the status of sea turtle populations in the Western Gulf of Mexico. In: K.Bjorndal (ed.) Biology and

conservation of Sea Turtles. Smithsonian Press. Washington, D.C. pp447-453). suggested that the Kemp's ridley historically was the "Louisiana" turtle, and the green turtle, the "Texas" turtle. Both species are rarely sighted using current survey methods but, both species utilize inshore and nearshore waters (Hildebrand, 1981). Thus, within bays of the Gulf of Mexico green and Kemp's ridley turtles are likely present but have not been detected via our aerial survey efforts.

List of Figures

Figure 1. Survey area for synoptic aerial sampling of the Gulf of Mexico. Line at the mouth of Mississippi River separates Northwest Gulf and Northeast Gulf. Blocks assigned "B" one includes bays and sounds; "I" includes waters <20m in surface to bottom depth; and "O" are >20m and <200m in depth.

Figure 2. Aerial survey turtle sightings for the NW Gulf of the synoptic surveys. Each dot represents a single sighting of a loggerhead turtle. Shrimp trawling effort is overlaid in 5000 days fished grids.

Figure 3. Aerial survey turtle sightings from the NE Gulf of the synoptic survey. Each dot represents a single loggerhead turtle sighting. Sightings in offshore blocks line up along sampled transects. Shrimp trawling effort is overlaid in 5000 days fished grids.

Figure 4. Aerial Survey sampling area from site specific surveys to evaluate turtle-oil platform distances. Shrimp trawling effort is overlaid in 5000 days fished grids.

Figure 5. Aerial surveys sightings form site specific sampling. Each dot represents a single sighting. Shrimp trawling effort is overlaid in 5000 days fished grids.

Figure 6. Turtles captured during the TED evaluation project off the NE Gulf. Eleven turtles were captured off the Florida Coast and one off Louisiana. Shrimp trawling effort is overlaid in 5000 days fished grids.

Figure 7. Turtles captured on the NW Gulf during the TED evaluation project. Three turtles were captured off Louisiana. Shrimp trawling effort is overlaid in 5000 days fished grids.

Figure 8. Know turtle "hotspots" where sightings of 20 or more separate turtles have been reported on a single day. Shrimp trawling effort in 5000 days fished grids were overlaid.

Figure 9. Locations of satellite tagged turtles. Circles represent "residency" for 1-9 months. Shrimp trawling effort in 5000 days fished grips were overlaid.

Figure 10. Opportunistic sightings of turtle in the NW Gulf. Shrimp trawling effort in 5000 days fished grids were overlaid.

Figure 11. Opportunistic sightings of turtles in the NE Gulf. Shrimp trawling effort in 5000 days fished grids were overlaid.

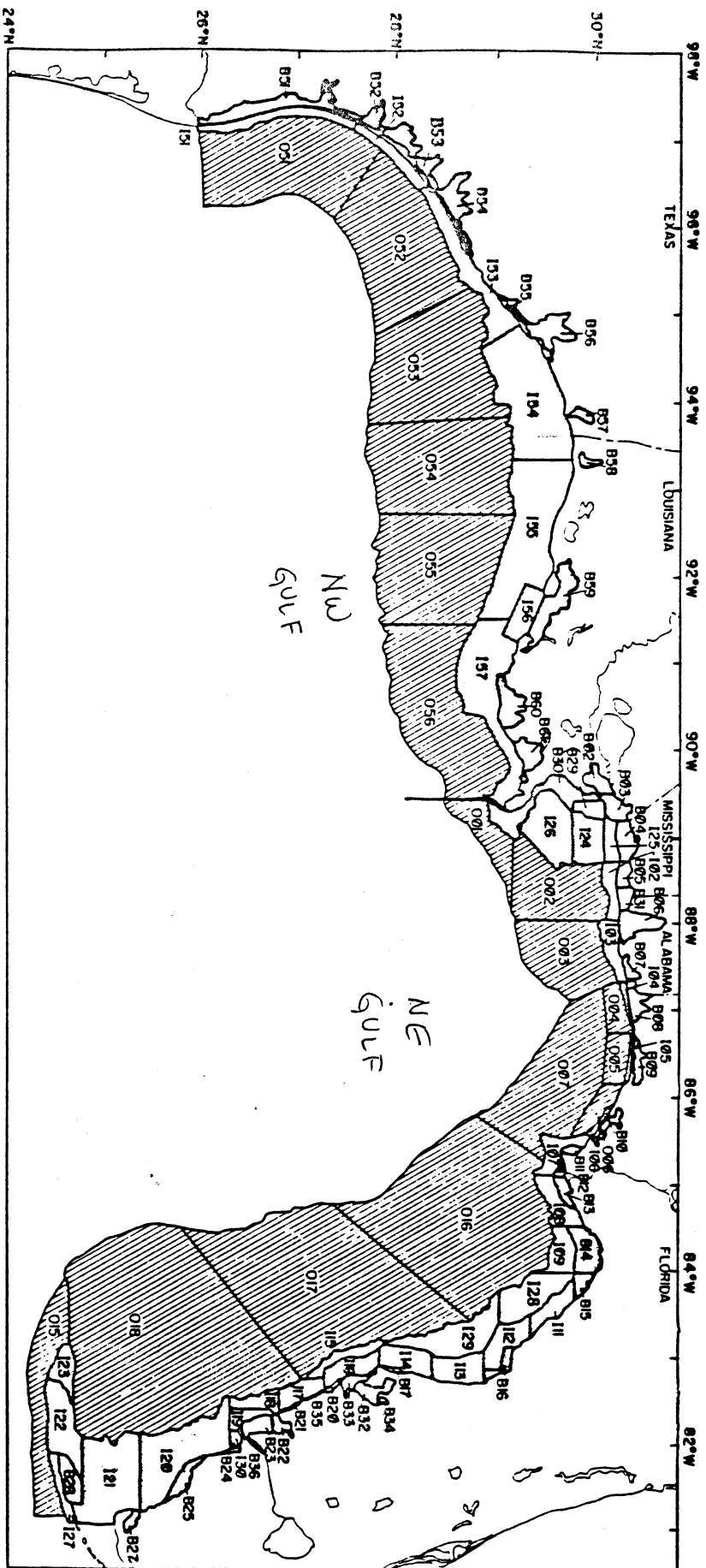
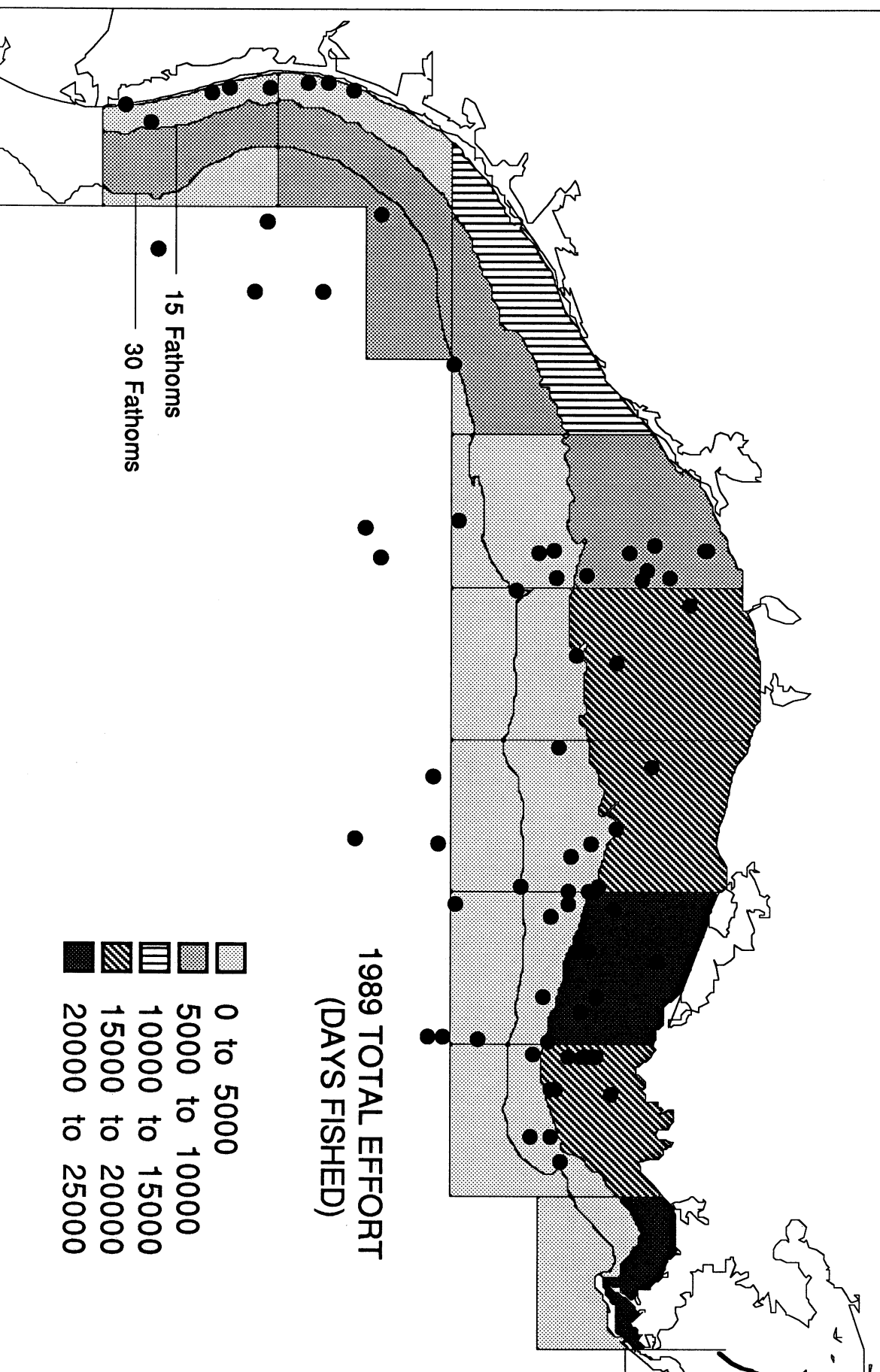


Figure 1 : Blocks flown in the eastern and western Gulf of Mexico

Aerial Survey Turtle Sightings, 1983-1985

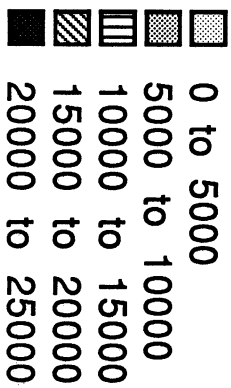
n = 70



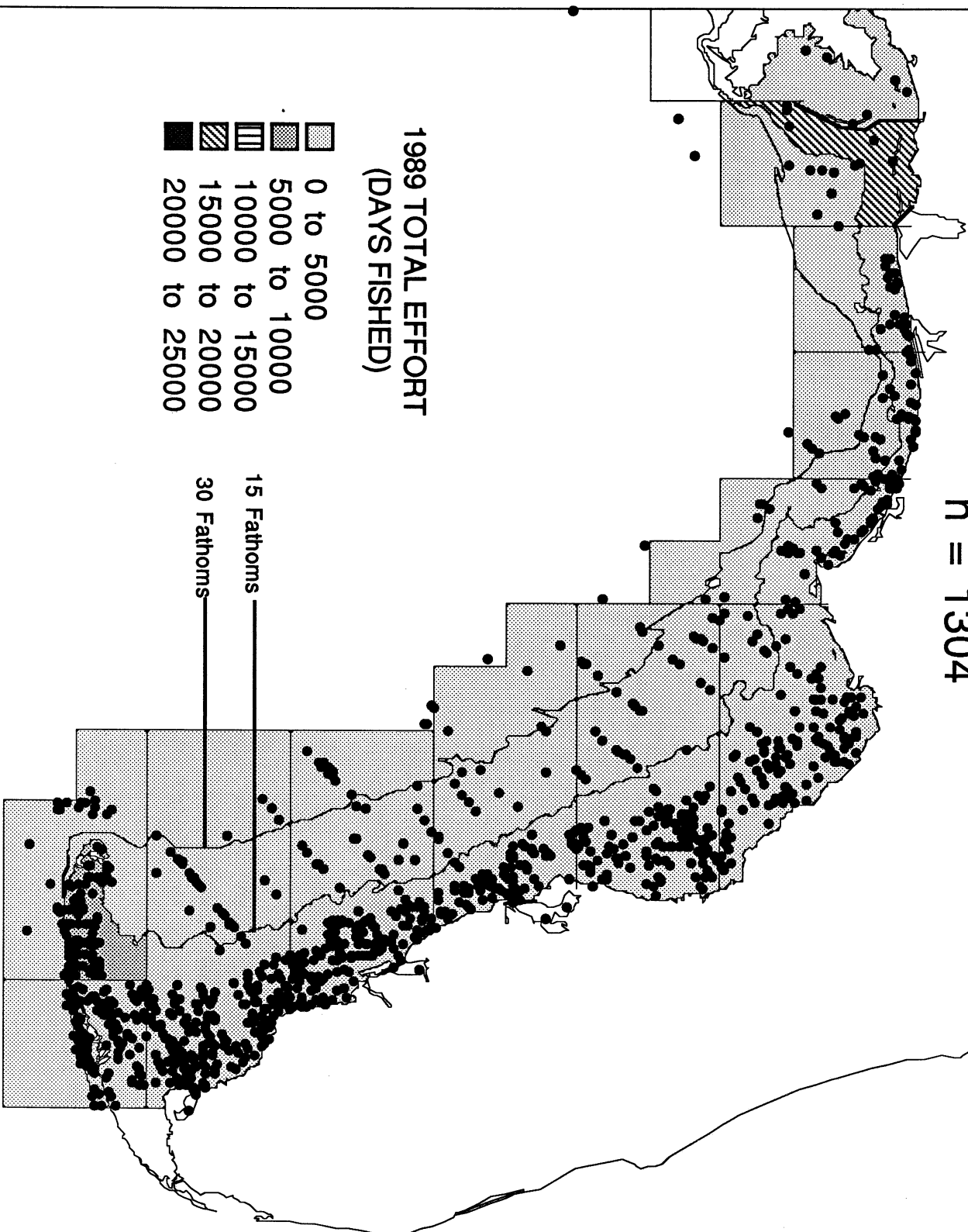
Aerial Survey Turtle Sightings, 1985-1986

n = 1304

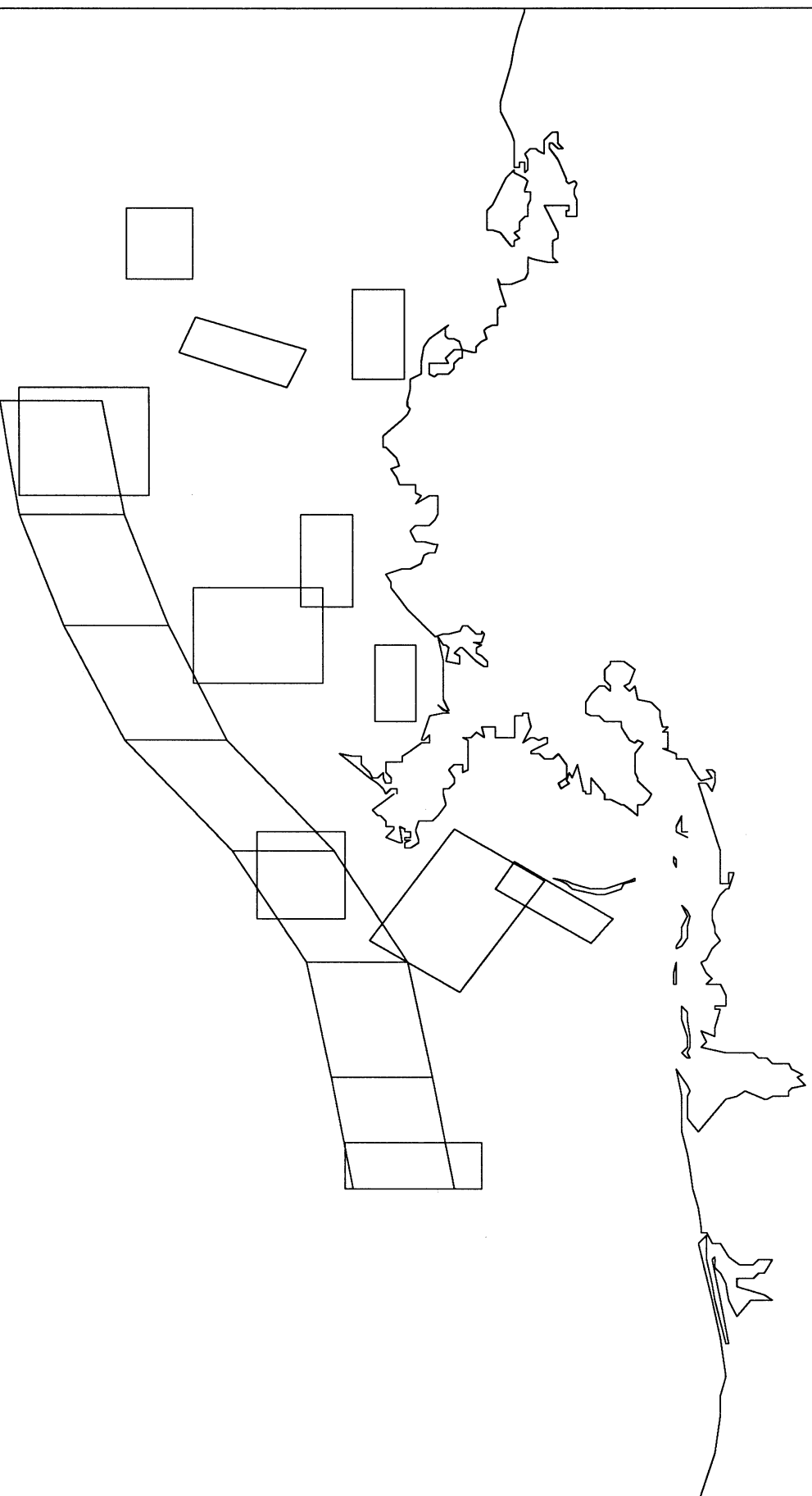
1989 TOTAL EFFORT
(DAYS FISHED)



15 Fathoms
30 Fathoms



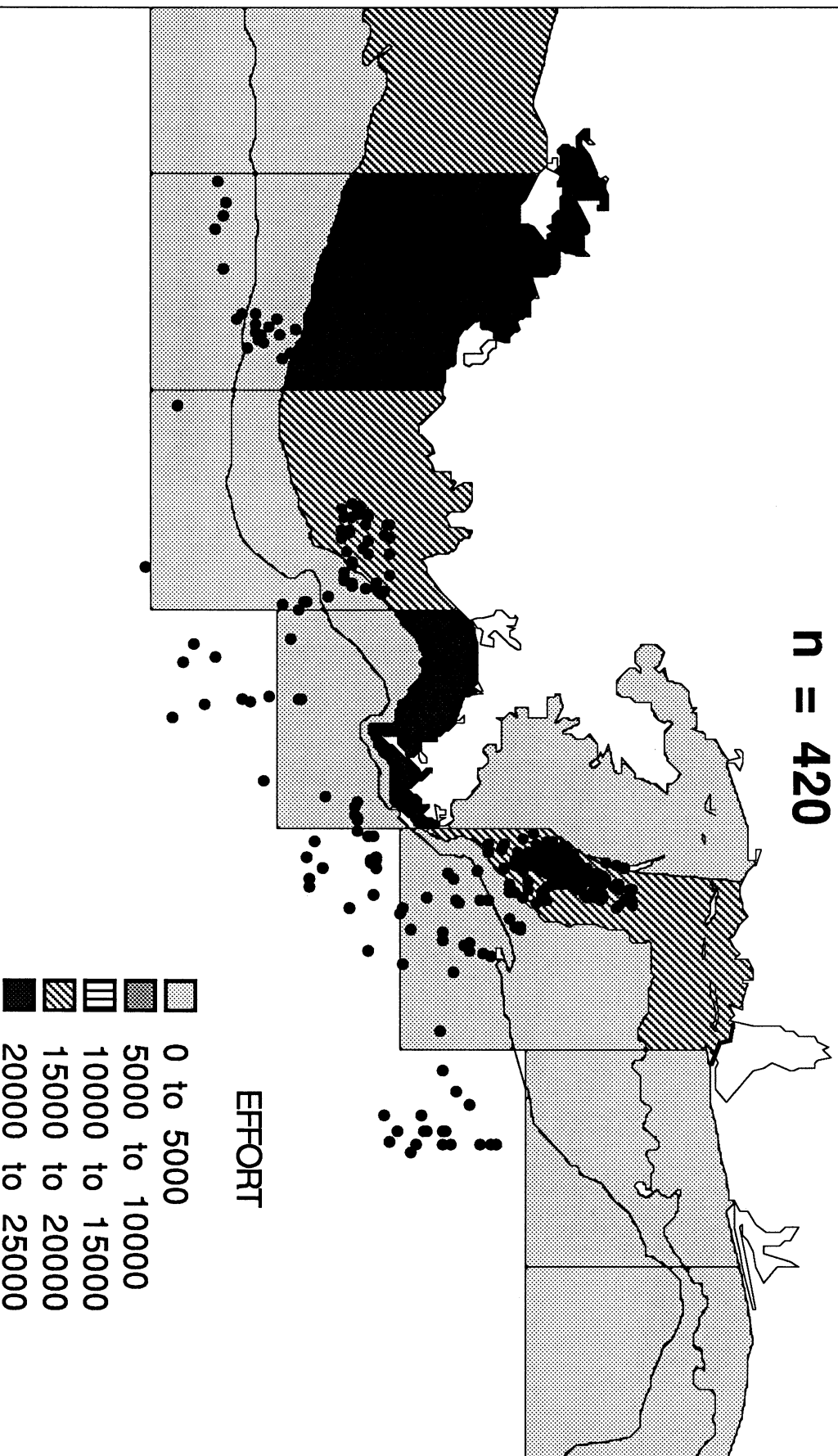
Aerial Survey Sampling Areas, June 1988-June 1990



Aerial Survey Turtle Sightings

June 1988 - June 1990

n = 420



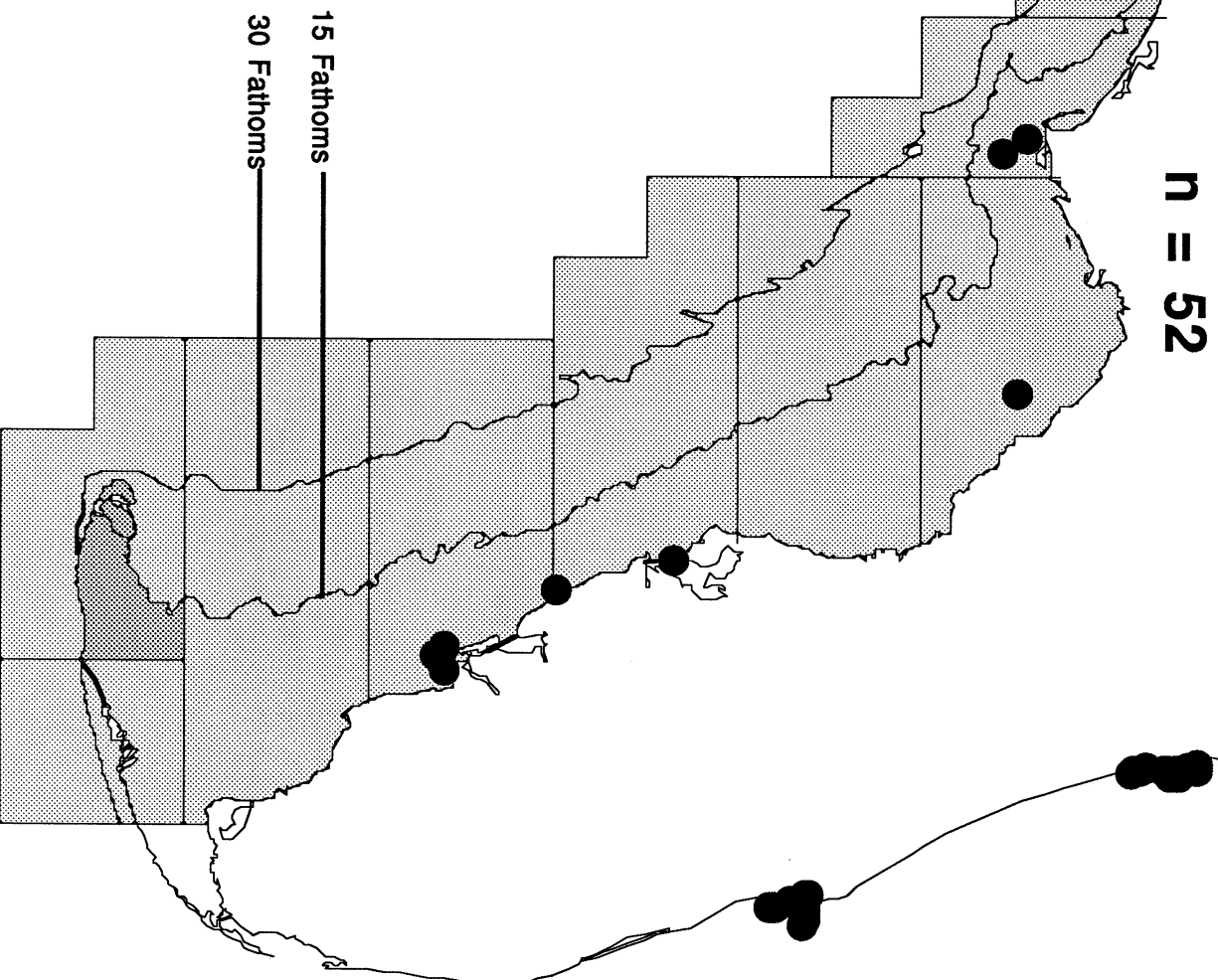
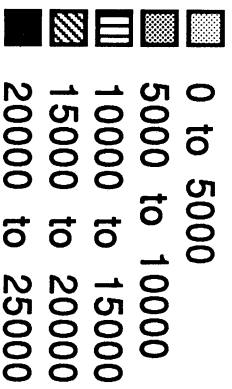
Concentration of sightings in central Gulf due to localized sampling effort.

TURTLES CAPTURED DURING TED EVALUATION PROJECT

March 1988 - August 1990

n = 52

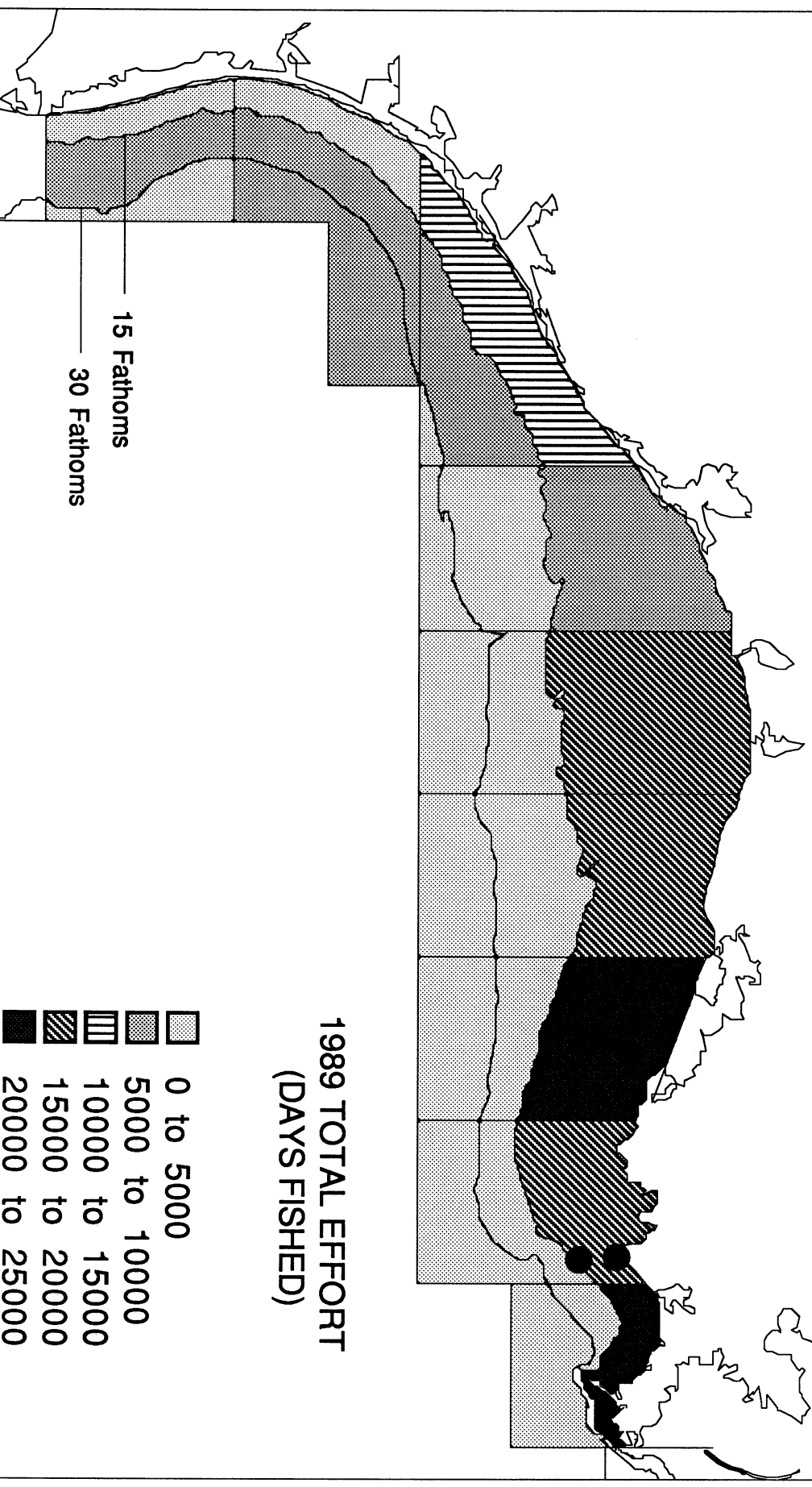
1989 TOTAL EFFORT
(DAYS FISHED)



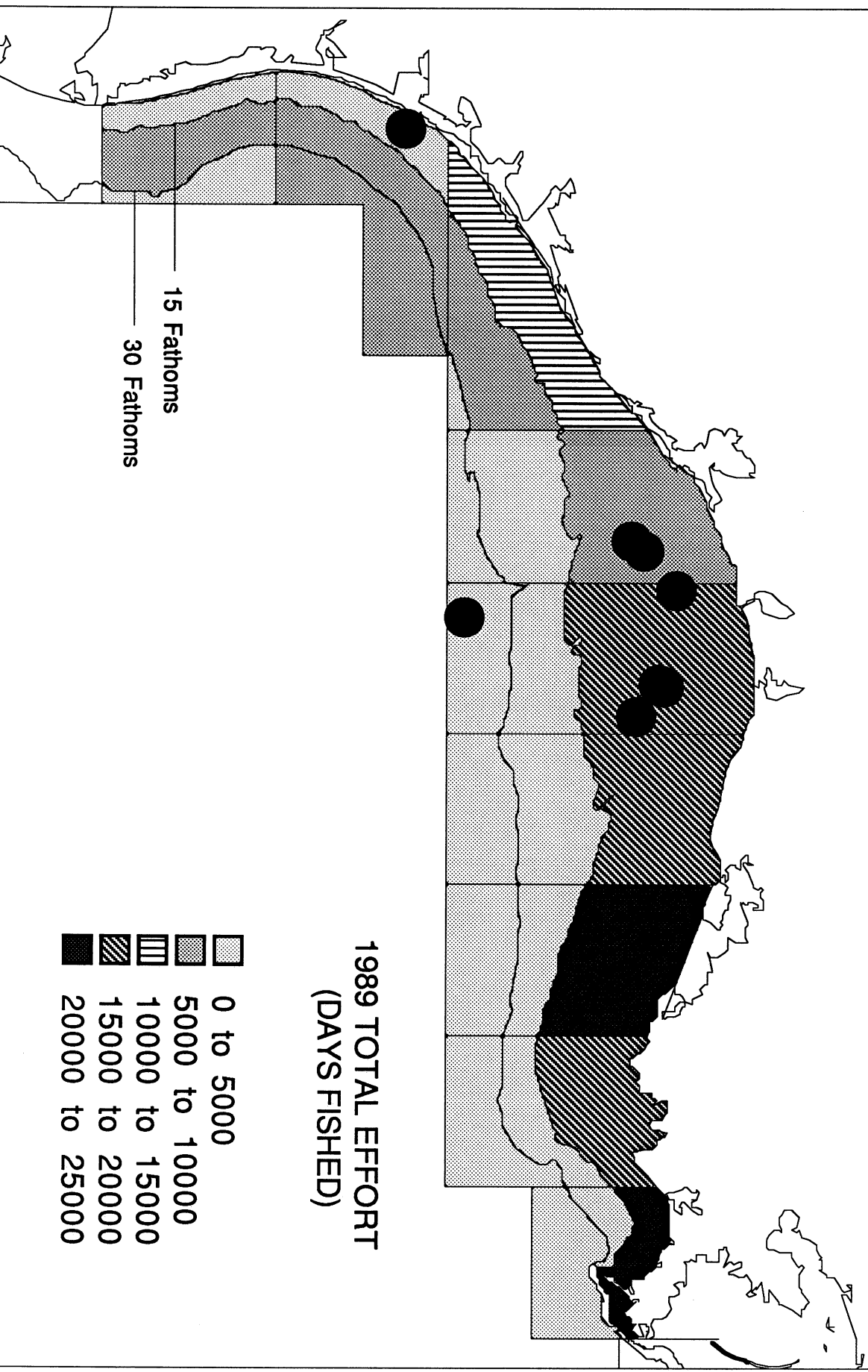
TURTLES CAPTURED DURING TED EVALUATION PROJECT

March 1988 - August 1990

n = 3

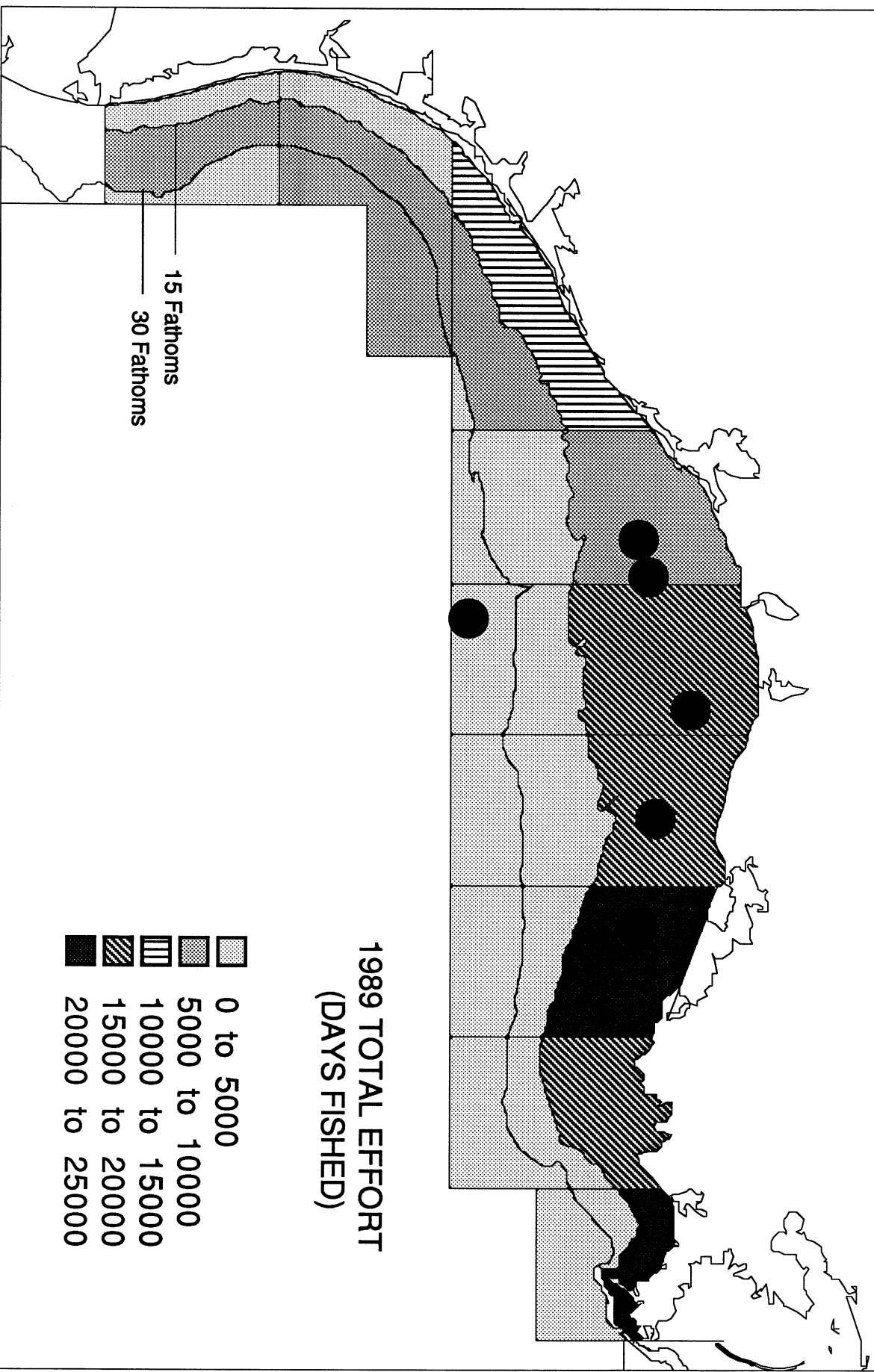


KNOWN TURTLE "HOTSPOTS" **October 1989 - November 1990**



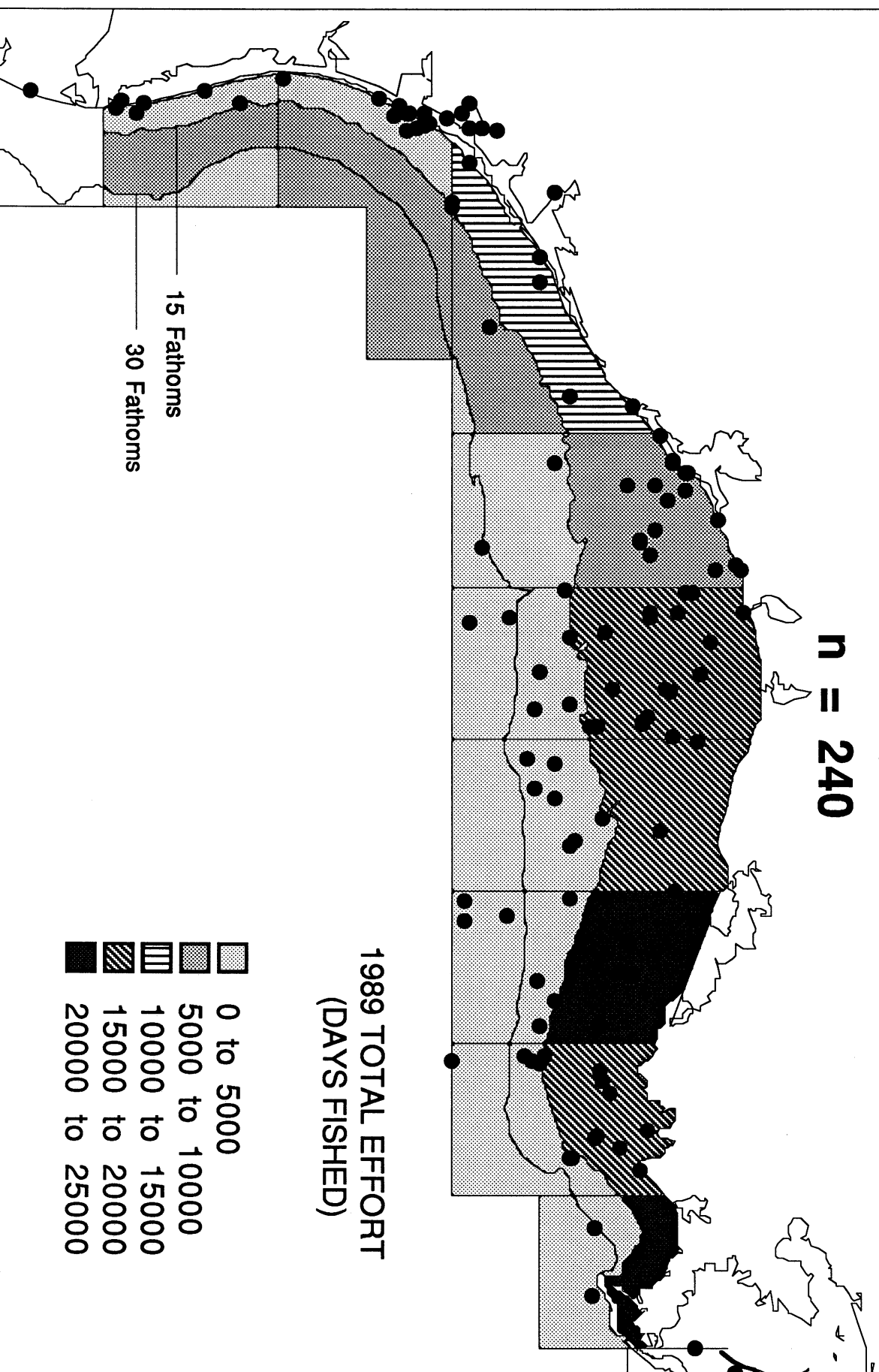
LOCATIONS OF SATELLITE TRACKED TURTLES

June 1989 - November 1990



TURTLE SIGHTINGS FROM THE WESTERN AND CENTRAL GULF OF MEXICO, 1985 - 1989

n = 240



TURTLE SIGHTINGS FROM THE CENTRAL AND EASTERN GULF OF MEXICO, 1985 - 1989

n = 32

**1989 TOTAL EFFORT
(DAYS FISHED)**

